Adaptation to Climate Change in the Desert Southwest: Impacts and Opportunities
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Our Thirst for Energy

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Water lubricates the American economy just as oil does. Water is also intimately linked to energy because it takes water to make energy, and it takes energy to divert, pump, move, and cleanse water. Water plays a critical role in virtually every segment of the economy, from heavy industry to food production, from making semiconductors to providing Internet service. A prosperous future depends on a secure and reliable water supply. And we don't have it. To be sure, water still flows from taps, but we're draining our reserves like a gambler at the craps table.

In this presentation, I will use the story of ethanol to illustrate the intimate connection between water and energy. Some critics contend that it takes more energy to produce ethanol than the ethanol itself generates. But the debate over ethanol's values and demerits has neglected another variable: water. Ethanol refineries consume enormous quantities of water in making the mash slurry, as well as during the cooling process from evaporation. Even with modern ethanol plants that allow water recycling, it takes more than four gallons of water for every gallon of ethanol produced. And first, farmers have to grow the corn to be used to refine the ethanol. It takes as much as 2500 gallons of water to grow enough corn to produce one gallon of ethanol.

Our energy-intensive economy imposes demands on water in other ways, some of them surprising and rarely reported. While most people think of Google as a high-tech company, the brains of its operation, what runs its search engine website, www.google.com, are "server farms," clusters of thousands of computers linked together. This many computers generates large amounts of heat which must be eliminated so as not to adversely affect the computers. Google, as well as Microsoft and Yahoo, use large quantities of water to cool the computers.

Water is a critical input for the energy industry, not only for power production, but also for mining, refining, processing and transporting oil, natural gas, coal, and other forms of energy. A typical 1000-megawatt coal-fired power plant consumes 10,000 gallons of water a minute through evaporation.

According to a 2001 report of the National Energy Policy Development Group, the United States will require 393,000 megawatts of new generating capacity by 2020. That amount of power will require between 1300 and 1900 new power plants, or more than one new plant built every week for 25 years. Yet since 2007, four different states have denied permits for new power plants because there was not enough water to run them.

Just as the energy industry uses lots of water, the water industry uses lots of energy. The 60,000 water systems and 15,000 wastewater systems in the United States use approximately 75 billion kilowatts per year of electricity – about three percent of the nation's energy consumption. To some people, the solution to water problems will be ocean desalination. But the desalination process consumes huge amounts of water and, because water is heavy, it takes considerable energy to move it. In California, a remarkable 19 percent of the state's electricity, 30 percent of its natural gas, and 88 billion gallons of diesel fuel are used to convey, treat, and distribute water and wastewater.

And our energy use and water are connected in a grand atmospheric scale as well. Global warming poses immense threats to regional supplies of water. In 2007, the National Research Council released a sobering report on the consequences of global warming for the Colorado River Basin. It ominously reports of "a future in which warmer conditions across the Colorado River region are likely to contribute to reductions in snow pack, and earlier peak and spring snow melt, higher rates of evapo-transpiration, reduced late spring and summer flows, and a reduction in annual run-off and stream flow." Scientists who have quantified the likely reductions in flow predict at the low end an 18% reduction by 2050, and at the high end a 45% reduction by 2060.

Global warming has significant implications for how we generate electricity. Lower flows in western rivers will mean less electricity generated from hydroelectric facilities – the most water-efficient form of power generation. A smaller snow pack will reduce the power generated by turbines at dams, which will require more electricity to be generated by other sources, which will require more water to generate that power. Bottom line: higher $C0_2$ emissions and water consumption.

Our thirst for energy has frightening implications for our economy and our environment. Energy to power our automobiles, run server farms, and light our homes takes a lot of water. And we seem not to have enough of either water or energy.